REVIEW ARTICLE

Malnutrition in Hospital

The Clinical and Economic Implications

Christian Löser

SUMMARY

Background: Undernutrition and malnutrition are common in hospitalized patients. Their combined prevalence on admission is estimated at 25% and is rising.

Methods: Selective literature review with special consideration of current guidelines and meta-analyses.

Results: The nutritional state of every patient should be assessed on admission with simple, established parameters, and patients suffering from under- or malnutrition should be treated with a targeted nutritional intervention based on the established stepwise treatment algorithm. Under- and malnutrition are an independent risk and cost factor with a significant influence on mortality, morbidity, length of hospital stay, and quality of life. Their direct costs alone amount to some 9 billion Euros in Germany each year. Therapeutic trials and meta-analyses have clearly documented the therapeutic benefit and cost-effectiveness of oral nutritional supplements and tube feeds. Targeted nutritional intervention is an integral part of medical treatment and prevention.

Conclusion: Undernutrition and malnutrition are common in hospitalized patients and are both medically and economically harmful. If they are detected early by targeted assessment and then treated appropriately according to the established stepwise treatment algorithm, better clinical outcomes and lower costs will result.

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Undernutrition and malnutrition are a common (prevalence above 25%) and increasing problem in German hospitals. Its medical and financial consequences are significant and have been well demonstrated scientifically. They are at least as significant for the German health and social service system as the well-known consequences of excess weight and obesity (1, 2).

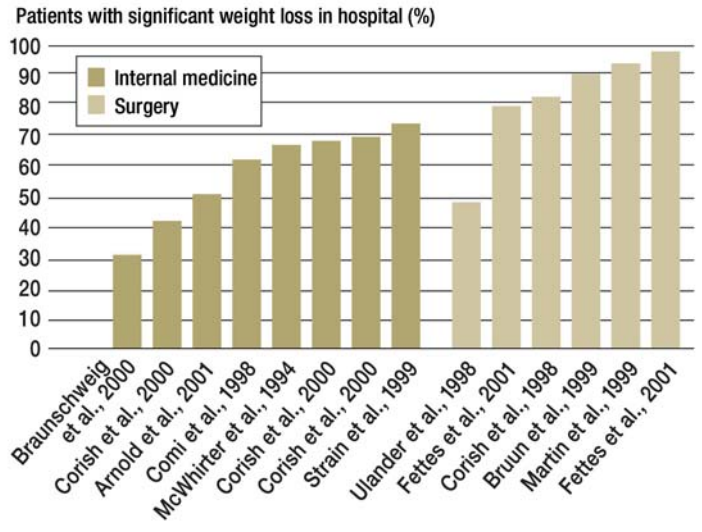
There are still no universal definitions for the terms undernutrition or malnutrition. Unfortunately, there is also no established gold standard for standardized detection and quantification. The current guidelines of the German Society for Nutritional Medicine (*Deutsche Gesellschaft für Ernährungsmedizin,* DEGM) define undernutrition as a reduction in the body's energy stores (primary target parameter: reduced fat mass) and malnutrition as either illness-associated weight loss, lack of protein (decreased muscle mass) or a deficit of specific essential nutrients (e1). According to current knowledge, early detection of under- or malnutrition and subsequent basic treatment using nutritional medicine not only has a significant effect on the individual patient's mortality, morbidity, tolerance of treatment, and complication rate, and therefore prognosis and quality of life, but in prospective clinical trials and meta-analyses also results in substantially shorter hospital stays and a significant reduction in individual costs (1, 3–8).

Almost no other area of medicine has seen such fundamental paradigm shifts in recent years as nutritional medicine. Today targeted nutrition is no longer considered as meeting a basic need: it is one of physicians' therapeutic and preventive treatment options. This selective literature review will discuss the medical and economic consequences and the established treatment strategies for under-/malnutrition on the basis of trials, meta-analyses, and guidelines of the relevant medical societies published to date, providing a practice-oriented summary.

Prevalence

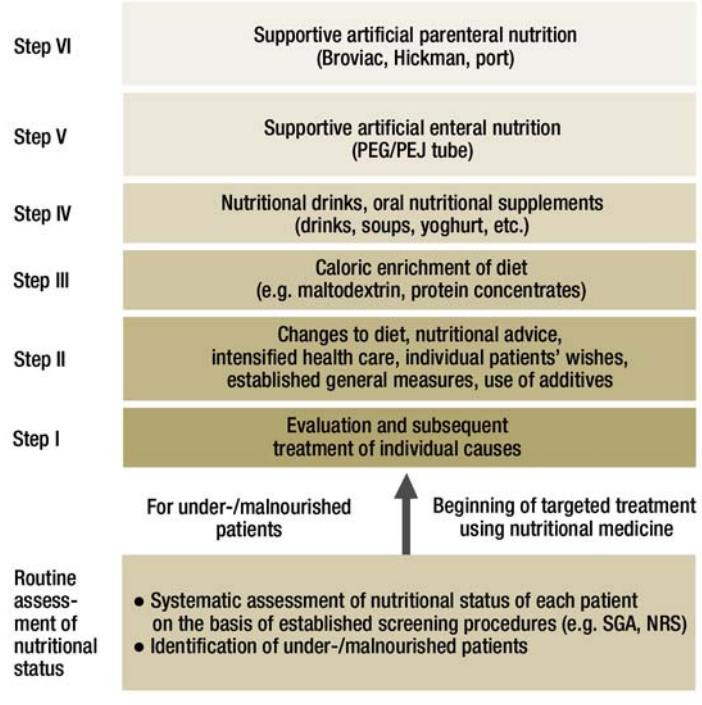
Since the mid-1970s there have been more than 200 published clinical trials which have systematically researched the prevalence of under-/malnutrition in hospital patients: according to the investigated patient

FIGURE 1



Extent of deterioration in nutritional status during hospital stay: conclusions of large published studies within the specializations internal medicine and surgery (modified according to R.J. Stratton et al. [4])

FIGURE 2



Systematic assessment and treatment strategies using nutritional medicine for under-/malnourished patients (modified according to current guidelines [17–19])

population, the definition of undernutrition used, and the assessment parameters used as a result, these clinical trials show a prevalence of between 20% and 60% on hospital admission (3, 4, 9–11, e2–e6). For the German-speaking world specifically, many large-scale prospective studies on the prevalence of under-/malnutrition have been published in recent years: in 2001 the author's working group published a single-center study which is still the largest ever conducted on the subject (9). Of a total of 1917 prospectively examined patients, 22% were found to be undernourished when admitted to the hospital. The proportion was significantly higher (25%) in patients receiving regular hospital care than in those at a university institution (20%). A multicenter study conducted all over Germany in a total of 1886 patients found that an even higher proportion, 27%, of patients were under-/malnourished (10). The study of Kyle et. al (11) (n = 1760) showed a prevalence as high as 31%.

In addition, further significant problems regarding patients' nutritional status occur during hospital stays. Clinical studies reveal that between 30% and over 80% of inpatients, depending on the specialty and the patient population investigated, progressively lose a substantial amount of weight during their hospital stay *(Figure 1)*. The prevalence of under-/malnutrition is significantly correlated with social factors (e.g. family and care status, educational level), patient age, and medical factors (malignant underlying diseases, multiple drug treatment) (9–11, e2–e5).

Causes

The causes of malnutrition in patients in Germany are complex (3, 4, 12, 14). The main cause is the patient's illness itself (disease-related malnutrition), which can interfere with adequate absorption and metabolism of food via a variety of mechanisms, such as infection-dependent changes in metabolism, loss of appetite, absorption or digestion disorders, disease-specific catabolism, etc. However, there are also many other major causes, such as poor dental health, poorly-fitting false teeth, social isolation, gastrointestinal symptoms, addictions, poverty/lack of money, mental illness (e.g. depression, dementia), swallowing disorders, changes in taste perception, complex medication, or an individual's inability to purchase or prepare food. Systematic early evaluation and the resulting treatment of potential underlying causes is an essential medical task as part of suitable treatment of patients at risk of under-/malnutrition *(Figure 2)*.

Determining nutritional status

Targeted clinical history (central question: loss of weight, dietary habits) and overall physical examination (muscle mass, subcutaneous fat) are certainly the most important general measures in detecting under-/malnutrition. Documenting dynamic parameters which are relevant to nutritional medicine, such as weight changes, appetite, gastrointestinal symptoms, or assessment of daily nutritional intake, is an important part of taking a patient's general clinical history.

TABLE 1

Established evaluation scores recommended in guidelines for simple detection of under-/malnutrition (3)

Subjective Global Assessment (SGA) [e39]	Nutritional Risk Score (NRS) [e40]			
Weight changes in the last 6 months (<5% = slight; >10% = significant)	Initial screening: – BMI <20.5 kg/m^2 – Weight loss (last 3 months) – Reduced nutritional intake/day (past week) – Severe illness			
Appetite, amount and type of nutritional intake	If the answer to any question is Yes, screening follows:			
Gastrointestinal symptoms – Nausea, vomiting, flatulence, pain, diarrhea	**Nutritional status, weight loss, amount of nutritional intake**			
		1 point	2 points	3 points
Functional capacity – Ability to function, mobility, ability to work	Weight loss >5%	In 3 months	In 2 months	In 1 month
	BMI (kg/m^2)		18.5–20.5	<18.5
	Nutritional intake (% of need)	50–75	25–50	0–25
Stress caused by underlying disease – Severity of disease	**Severity of disease, metabolic stress**			
Physical examination – Muscle mass, subcutaneous fat – Edema, ascites		1 point	2 points	3 points
		e.g. hip fracture, cirrhosis of the liver, COPD	e.g. apoplexy, major abdominal surgery, leukemia	e.g. head trauma, bone marrow transplant, intensive care patients
	Age >70 years: add 1 point			
A = normal B = slight malnutrition C = severe malnutrition	Score 0–3 = reduced nutritional status, monitoring needed Score >3 = begin nutritional intervention			

In the SGA the assessor must consider asking the six subquestions individually and choose A, B or C on the basis of his/her resulting subjective impression alone

Of the many publicized parameters for specific diagnosis of nutritional status, the Subjective Global Assessment (SGA) score, Nutritional Risk Score (NRS 2002), and for older patients the Mini Nutritional Assessment score (MNA) have been established in recent years as reliable, reproducible, easy-to-learn methods *(Table 1)* (3, 4, 12, e7–e9). Using one of these scores and body mass index (BMI), the individual nutritional status of each patient should be ascertained routinely when patients are hospitalized so that patients at risk of under-/malnutrition can be identified early, on admission, and be treated using targeted nutritional medicine.

Clinical consequences

The complex clinical consequences of under-/malnutrition are obvious and have been well demonstrated scientifically for some years in many prospective clinical trials and meta-analyses (1, 3, 4, 7, 8, 12–14, e7–e10). According to the available data, under-/malnutrition is an independent risk factor with a significant effect on the important clinical parameters of mortality, morbidity, complication rates, length of hospital stay, tolerance of treatment, quality of life, and prognosis *(Table 2)* (3, 4, 7, 8, 12, 14, e7–e10).

EuroOOPS (13), a Europe-wide multicenter clinical study conducted in more than 5000 patients in 26 hospitals, shows higher mortality (12% versus 1%), significantly longer hospital stays (9 versus 6 days; $p<0.001$), and a significantly higher complication rate (odds ratio 3.47; $p<0.001$) for under-/malnourished patients and patients at risk of under-/malnutrition according to the NRS. A current review article by Norman et al. (14), published in 2008, summarizes and explores the significant correlation between malnutrition and morbidity, mortality, and length of hospital stay and the consequently higher treatment costs.

Treatment strategies

A stepwise treatment algorithm *(Figure 2)* has been established for practice in nutritional medicine for patients no longer able to eat adequately because of their illness.

After individual evaluation and treatment of underlying causes, the next step is an individual nutritional clinical history with changes made to patients' diets with consideration of patients' individual wishes using easy-to-digest, high-energy options. Also, there are many other general measures established in practice,

TABLE 2

Clinical consequences of progressive under-/malnutrition demonstrated in scientific studies

Immunocompetence	⇩
Rate, duration, and severity of infections	⇧
Overall complication rate	⇧
Healing disorders, decubitus ulcers	⇧
Immobility, risk of falling	⇧
General health	⇩
Mental state	⇩
Need of help and care, infirmity	⇧
Tolerance of treatment	⇩
Quality of life	⇩
Morbidity	⇧
Mortality	⇧
Prognosis	⇩

TABLE 3

The effect of nutritional drinks/oral supplements on mortality and complication rates according to various published meta-analyses (modified according to 8)

Meta-analyses	Complication rate	Mortality
Potter et al. (2001)		0.61 (CI 0.45–0.82)*[1]
Stratton et al. (2003)	0.29 (CI 0.18–0.47)*[1]	0.62 (CI 0.49–0.76)*[1]
Stratton et al. (2005) *[3]	0.79 (CI 0.62–0.89)*[1]	
NICE (2006)	0.71 (CI 0.61–0.82)*[1]	0.81 (CI 0.68–0.97)*[1]
Milne et al. (2006)*[2]	0.72 (CI 0.53–0.79)*[1]	0.66 (CI 0.49–0.90)*[1]
Stratton et al. (2007)	0.37 (CI 0.23–0.60)*[1]	
Milne et al. (2009)		0.79 (CI 0.64–0.97)*[1]

Odds ratios with 95% confidence intervals;
*[1] statistically significant result;
*[2] only patients with under-/malnutrition during hospitalization;
*[3] specific evaluation concerning pressure sores/decubitus ulcers
CI: 95% confidence interval

such as the use of special flavor enhancers, eating in pleasant surroundings and good company, special nutritional education for family members providing care, encouraging physical activity between meals, or prescribing small, frequent portions of high-energy food between meals (finger food, snacks, high-energy drinks) throughout the day. Extra energy can also be added to patients' diets using economical, energy-rich additives with no odor or flavor, such as maltodextrin or specific protein concentrates.

In order to make good use of today's knowledge of nutritional medicine, nutritional support teams are needed in hospitals. These teams must consist of doctors in charge of nutrition, care staff trained in nutrition, dietary assistants, and/or dieticians. The structure, organization, and tasks of a nutritional support team have been established; the clinical and financial efficiency of a qualified nutritional support team has also been shown in studies and one meta-analysis (15, e11–e15).

Nutritional drinks/oral nutritional supplements

There is almost no pharmacological treatment established in medical practice in which so many clinical studies (more than 200) and meta-analyses have been published in the literature as in therapeutic benefit of nutritional drinks and additional oral nutrition: to date there are 14 published meta-analyses (4, 5, 8, 16, e16–e23), and there is already a summary analysis, or review of reviews (8), on the available review articles and meta-analyses (1, 3–5, 8, 12, 16–18).

In a meta-analysis, Stratton et al. (4) were able to ascertain that the addition of nutritional drinks to the diets of patients with under-/malnutrition significantly reduced both the complication rate (odds ratio 0.29 [95% confidence interval [CI] 0.18–0.47]) and mortality (odds ratio 0.62 [95% CI 0.49–0.76]). These significant effects are also seen in malnourished patients who receive additional nutritional drinks or oral nutritional supplements during short hospital stays. Milne et al. (16) also found a significant decrease in the complication rate, by 28%, in these patients, and a drop in mortality as large as 34% after prescription of additional nutritional drinks. *Table 3* summarizes the relevant conclusions of the most important available meta-analyses.

Nutritional drinks and oral nutritional supplements are available in more than 30 different flavors. They should be given between rather than at mealtimes, or even better in the evening as supplements to patients' diets. If a patient is only able to eat a little (e.g. geriatric patients, tumor patients), high-calorie nutritional drinks with an enriched calorie content of 1.5 to 2.7 kcal/mL can also be offered. If medically indicated, nutritional drinks/oral supplements can be prescribed by physicians and must be funded by statutory health insurance in Germany (German Federal Gazette, issue 188, dated September 1, 2005).

Artificial nutrition

If all the measures mentioned above *(Figure 2)* have been tried with no lasting therapeutic benefit, supportive artificial nutrition must be considered (3, 4, 12, 19). In addition to medical indications (underlying disease, patients' individual health status, any comorbidities, expected prognosis, mental/psychological status, individual patients' wishes), ethical issues (particularly in the case of elderly patients with multiple disorders and tumor patients in advanced stages of illness) must also be considered on an individual basis. Clinical trials

show significantly better quality of life, in addition to a significant improvement in nutritional status, reduced complication rates, and improved individual prognosis, for supportive nutritional therapy via PEG/PEJ tube (4, 19–21, e24–e27). *Figure 3* shows changes in weight in a prospective clinical study (20) in 210 consecutive patients with various benign and malignant underlying diseases who were closely observed for one year after a PEG was fitted. The main conclusions of this study, which have been confirmed several times since then, are as follows:

- Both patient groups lost an average of 12 kg of weight in the last three months before the possibility of supportive PEG tube nutrition was considered.
- Supportive nutrition via PEG tube can halt this massively progressive catabolism very efficiently. This is also also true for many patients with malignant underlying diseases.
- However, supportive PEG tube nutrition is unable to regain weight already lost by patients, even with benign underlying diseases, according to the statistical average *(Figure 3)*.

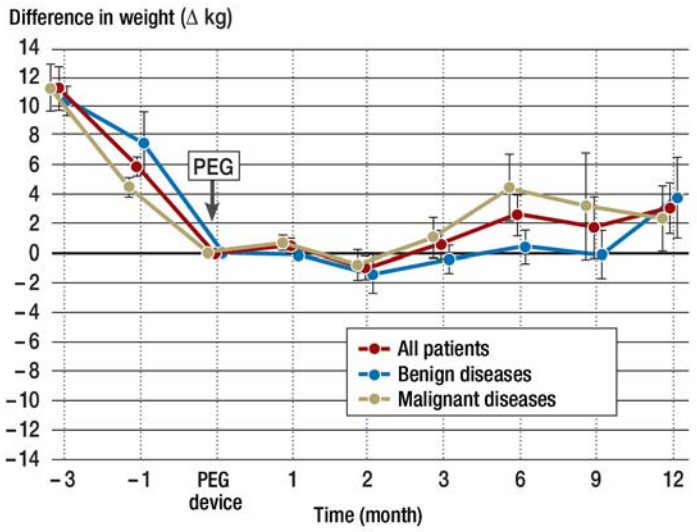
According to today's medical understanding, nutrition via PEG tube is supportive, preventive, and usually temporary; it is the first-choice method worldwide for artificial nutrition expected to be needed for more than two weeks, and can be ended at any time after normal oral intake has been resumed (4, 19–21, e24–e27). The dilemma of PEG (12, 19), which is often used as a synonym for artificial nutrition, is that discussion of PEG systems within the medical profession and by the public is usually one-sided, concentrating on problems with patients who are elderly, have multiple disorders, and/or suffer from dementia, in whom it has been shown that enteral tube systems are actually used too uncritically and often without good ethical grounds (we fit too many PEG tubes in the wrong patients). In patients who the evidence shows benefit significantly from supportive PEG tube nutrition (e.g. patients receiving chemotherapy or radiotherapy), it is considered far too rarely and usually far too late (we insert too few PEG tubes far too late in the right patients) (3, 4, 12, 18–21, e24–e33).

If there are contraindications against enteral nutrition, which is rare, parental catheter systems (Broviac or Hickman catheters) can also be used. In patients receiving chemotherapy who have port systems, supportive nutrition can be given in addition (12, 18, 19).

Costs/budgeting: a paradigm shift

Under-/malnutrition not only significantly worsens morbidity and mortality but is also a disease-independent, highly significant cost factor (1, 3, 4, 6–8, 12, 14, 22–24). The CEPTON study, published in 2007 (25), has calculated on the basis of the available scientific literature that additional costs to the German health-care system which are directly associated with under-/malnutrition are approximately 9 billion euros annually.

FIGURE 3



Changes in body weight in all patients (n = 210) and separately for patients with benign and malignant underlying diseases retrospectively for three months before and prospectively twelve months after a PEG tube is fitted (20)

Still more relevant from a medical/financial point of view are the results of the many intervention studies which show that the subsequent treatment of under-/malnutrition, e.g. using nutritional drinks/oral nutritional supplements, are highly cost-effective and economical (1, 3, 4, 6, 22–25, e34–e38). Amaral et al. (23) successfully demonstrated in a total of 469 patients that under-/malnourished patients and patients at risk of under-/malnutrition incurred an average of 19.3% higher costs than the average for corresponding diagnosis-related groups (DRGs), where the 95% confidence interval for the resulting additional costs was between 200 and 1500 euros per case. Kruizenga et al. (22) showed in their study, which involved 588 patients, that early nutritional intervention in malnourished patients reduced the length of hospital stays by 2.5 days when compared to patients cared for in the routine way; in other words, only an additional 76 euros per patient needs to be found to reduce the patient's hospital stay by one day. Russell (1) systematically analyzed the available studies into the efficiency of oral nutritional drinks perioperatively and found that prompt intervention could effectively save approximately 1000 euros per patient. This is an example of medical needs being absolutely hand-in-hand with operational and health economics–based considerations and requirements.

The high number of available studies have led to a paradigm shift in attitudes to supportive enteral nutrition. It used to be assumed across the board that resources needed to be invested in clinical nutrition of patients while the extent to which these expenses contributed to cost-efficiency by shortening hospital stays

could not be foreseen. Today, however, the available studies and meta-analyses lead to the opposite argument: early treatment of malnutrition is one of the last remaining effective ways to save money in health care (1, 2, 4, 6–8, 22–25, e34–e38).

Health policy is also being re-thought. In both the major Council of Europe resolution (7) and very new programs (Stop Malnutrition), the EU describes the high number of undernourished patients in European hospitals as completely unacceptable and decisively confirms the unequivocally demonstrated medical/clinical consequences and the huge unnecessary additional costs for health care (2, 7, e38).

Practical application

The medical societies have made specific suggestions and proposals to apply today's knowledge of nutritional medicine in order to diagnose and treat under-/malnutrition (17–19):

- A qualified nutritional support team must be established: the structure, organization, tasks, and cost-efficiency of a nutritional support team have been established (15, e11–e15).
- Immediately on admission, all patients' nutritional status must be systematically evaluated using established, simple, quick-to-use parameters. Specific recommendation: SGA/BMI or NRS/BMI as routine assessment for all newly admitted patients.
- Patients with under-/malnutrition should then receive standardized nutritional intervention on the basis of the established stepwise algorithm *(Figure 2)* (internal hospital standards).
- Hospitals must compile a binding list of diet types which also contains special energy-rich menu items, including energy-rich snacks (shakes, soups, finger food).
- According to evidence-based knowledge available to us, nutritional intervention such as nutritional drinks/oral supplements and, where applicable, supportive additional tube feeding must be considered an integral part of medical treatment and prevention in under-/malnourished patients. It must also be used much more aggressively in individual cases.
- In view of its great significance, nutritional medicine must finally become an essential part of the training of medical students and specialized physicians.

Conflict of interest statement
The author declares that no conflict of interest exists according to the guidelines of the International Committee of Medical Journal Editors.

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REFERENCES

1. Russell CA: The impact of malnutrition on healthcare costs and economic considerations for the use of oral nutritional supplements. Clin Nutr 2007; Suppl 1: 25–32.
2. Garel P: Putting medical nutrition onto the international agenda: Actions by the European Nutrition for Health Alliance. Clin Nutr 2007; Suppl 1: 39–43.
3. Löser Chr: Mangelernährung im Krankenhaus – Prävalenz, klinische Folgen, Budgetrelevanz. Dtsch Med Wschr 2001; 126: 729–34.
4. Stratton RJ, Green CJ, Elia M: Disease-related malnutrition: an evidence-based approach to treatment. Oxon: CABI Publishing 2003.
5. National Institute for Health and Clinical Excellence (NICE): Nutrition support in adults: oral nutrition support, enteral tube feeding and parenteral nutrition (clinical guideline 32); London: National Institute for Health and Clinical Excellence (NICE) 2006.
6. Tucker HN, Miguel G: Cost containment through nutrition intervention. Nutr Rev 1996; 54: 111–21.
7. Council of Europe, Committee of Ministers: Resolution ResAP on food and nutritional care in hospitals; ResAP 12 November 2003.
8. Stratton R, Elia M: A review of reviews: A new look at the evidence for oral nutritional supplements in clinical practice. Clin Nutr 2007; 26(Suppl 1): 5–23.
9. Löser Chr, Falk D: Prävalenz von Unter- und Überernährung bei stationären Patienten einer Uniklinik – Prospektive Studie an 1288 konsekutiven Patienten. Z Gastroenterol 2001; 39: 747.
10. Pirlich M, Schütz T, Norman K, et al.: The German hospital malnutrition study. Clin Nutr 2006; 25: 563–72.
11. Kyle UG, Pirlich M, Schütz T, et al.: Prevalence of malnutrition in 1760 patients at hospital admission: a controlled population study of body composition. Clin Nutr 2003; 22: 473–81.
12. Löser Chr, Lübbers H, Mahlke R, et al.: Der ungewollte Gewichtsverlust des alten Menschen. Dtsch Ärzteblatt 2007; 49: 3411–20.
13. Sorensen J, Kondrup J, Prokopowicz J, et al.: An international, multicentre study to implement nutritional risk screening and evaluate clinical outcome. Clin Nutr 2008; 27: 340–9.
14. Norman K, Richard C, Lochs H, et al.: Prognostic impact of disease-related malnutrition. Clin Nutr 2008; 27: 5–15.

KEY MESSAGES

- Under-/malnutrition is an increasingly common problem (prevalence 25%) in German hospitals, with scientifically-established significant clinical and economic consequences.
- Under-/malnutrition is an independent risk factor which significantly worsens patients' morbidity, mortality, tolerance of treatment, complication rates, and quality of life.
- Clinical intervention studies and meta-analyses establish decisively that giving supportive nutritional drinks/oral supplements or tube feeding via an enteral nutrition system can significantly improve the mortality, morbidity, complication rates, length of hospital stay, and quality of life of patients with under-/malnutrition.
- Artificial nutrition (e.g. via a PEG tube) has always required a medical and ethical indication and depends on individual circumstances; it is supportive, preventive, and usually temporary and should therefore be considered promptly for relevant patients.
- According to the knowledge and understanding available to us today, nutrition and targeted nutritional intervention are an integral part of medical treatment and prevention and are not primarily the satisfaction of a basic need.

15. Shang E, Hassenberg T, Schlegel B, et al.: An European survey of structure and organisation of nutrition support teams in Germany, Austria and Switzerland. Clin Nutr 2005; 24: 1005–13.
16. Milne AC, Avenell A, Potter J: Meta-analysis: protein and energy supplementation in older people. Ann Intern Med 2006; 114: 37–48.
17. Volkert D, Berner YN, Berry E, et al.: ESPEN Guidelines on enteral nutrition: geriatrics. Clin Nutr 2006; 25: 330–60.
18. Arends J, Bodoky G, Bozzetti F, et al.: ESPEN Guidelines on enteral nutrition – non-surgical oncology. Clin Nutr 2006; 25: 245–59.
19. Löser Chr, Aschl G, Hébuterne X, et al.: ESPEN Guidelines on artificial enteral nutrition – Percutaneous endoscopic gastrostomy (PEG). Clin Nutr 2005; 24: 848–61.
20. Löser Chr, Wolters S, Fölsch UR: Enteral long-term nutrition via percutaneous endoscopic gastrostomy (PEG) in 210 patients: a four-year prospective study. Dig Dis Sci 1998; 43: 2549–57.
21. Löser Chr, von Herz U, Küchler Th, Rzehak P, et al: Quality of life and nutritional state in patients on home tube feeding. Nutrition 2003; 19: 605–11.
22. Kruizenga HM, Van Tulder MW, Seidell JC, et al.: Effectiveness and cost-effectiveness of early screening and treatment of malnourished patients. Am J Clin Nutr 2005; 82: 1082–9.
23. Amaral TF, Matos LC, Tavares MM, et al.: The economic impact of disease-related malnutrition at hospital admission. Clin Nutr 2007; 26: 778–84.
24. Correia MITD, Waitzberg DL: The impact of malnutrition on morbidity, mortality, length of hospital stay and costs evaluated through a multivariante model analysis. Clin Nutr 2003; 22: 235–9.
25. Müller MC, Uedelhofen KW, Wiedemann UCH: „CEPTON-Studie: Mangelernährung in Deutschland." Erlangen: Bressler Druck 2007.

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eReferences

e1. Pirlich M, Schwenk A, Müller MJ, et al.: DGEM-Leitlinie enterale Ernährung: Ernährungsstatus. Aktuel Ernaehr Med 2003; 28: 10–25.

e2. Pirlich M, Schütz T, Kemps M, et al.: Prevalence of malnutrition in hospitalized medical patients: Impact of underlying disease. Dig Dis 2003; 21: 245–51.

e3. Volkert D, Kruse W, Oster P, et al.: Malnutrition in geriatric patients: diagnostic and prognostic significance of nutritional parameters. Ann Nutr Metab 2007; 36: 97–112.

e4. Löser Chr, Böhmer U: Ernährungszustand von stationären Patienten einer internistischen Abteilung eines Krankenhauses der Regelversorgung. Z Gastroenterol 2001; 39: 751.

e5. Rosenbaum A, Piper S, Riemann JF, et al.: Mangelernährung bei internistischen Patienten – eine Screeninguntersuchung von 1 308 Patienten mit Verlaufsbeobachtung. Aktuel Ernaer Med 2007, 32: 181–4.

e6. McWhirter JP, Pennington CR: Incidence and recognition of malnutrition in hospital. Br Med J 1994; 308: 945–8.

e7. Pirlich M, Luhrmann N, Schütz T, et al.: Mangelernährung bei Klinikpatienten: Diagnostik und klinische Bedeutung. Akt Ernaehr Med 1999; 24: 206–66.

e8. Braunschweig C, Gomez S, Sheean PM: Impact of declines in nutritional status on outcomes in adult patients hospitalized for more than 7 days. J Am Diet Assoc; 100: 1316–22.

e9. Reilly HM: Nutrition in clinical management: malnutrition in our midst. Proc Nutr Soc 1996; 55: 841–53.

e10. Schneider SM, Veyres P, Pivot X, et al.: Malnutrition is an independent factor associated with nosocomial infections. Br J Nutr 2004; 92: 105–11.

e11. Suchner U, Dormann A, Hund-Wissner E, et al.: Anforderungen an Struktur und Funktion eines Ernährungsteams. Anaesthesist 2000; 49: 675–84.

e12. Senkal M, Dormann A, Stehle P, et al.: Survey on structure and performance of nutritionsupport teams in Germany. Clin Nutr 2002; 21: 329–35.

e13. Rasmussen HH, Kondrup J, Staun M, et al.: A method for implementation of nutritional therapy in hospitals. Clin Nutr 2006; 25: 515–23.

e14. Kennedy JF, Nightingale JM: Cost savings of an adult hospital nutrition support team. Nutrition 2005; 21: 1127–33.

e15. Scott F, Beech R, Smedley F, et al.: Prospective, randomized, controlled, single-blind trial of the costs and consequences of systematic nutrition team follow-up over 12 month after percutaneous endoscopic gastrostomy. Nutrition 2006; 21: 1071–7.

e16. Baldwin C, Parsons T, Logan S: Dietary advice for illness-related malnutrition in adults. Cochrane Database Syst Rev 2001; CD002008

e17. Langer G, Schloemer G, Knerr A, et al.: Nutritional interventions for preventing and treating pressure ulcers. Cochrane Database Syst Rev 2003; CD003216

e18. Elia M, Van Bokhorst-de Van der Schueren M, Garvey J, et al.: Enteral (oral or tube administration) nutritional support and eicosapentaenoic acid in patients with cancer: a systematic review. Int J Oncol 2006; 28: 5–23.

e19. Ferreira IM, Brooks D, Lacasse Y, et al.: Nutritional supplementation for stable chronic obstructive pulmonary disease. Cochrane Database Syst Rev 2005; CD000998

e20. Elia M, Ceriello A, Laube H, et al.: Enteral nutritional support and use of diabetes-specific formulas for patients with diabetes. A systematic review and meta-analysis. Diabetes Care 2005; 28: 2267–79.

e21. Lewis SJ, Egger M, Sylvester PA, et al.: Early enteral feeding versus ´nil by mouth´ after gastrointestinal surgery: systematic review and meta-analysis of controlled trials. Br Med J 2001; 323: 773–6.

e22. Avenell A, Handoll HH: Nutritional supplementation for hip fracture aftercare in older people. Cochrane Database Syst Rev 2005: CD001880

e23. Potter JM: Oral supplements in the elderly. Curr Opin Clin Nutr Metab Care 2001; 4: 21–8.

e24. Lee JH, Machtay M, Unger LD, et al.: Prophylactic gastrostomy tubes in patients undergoing intensive irradiation for cancer of the head and neck. Arch Otolaryngol Head Neck Surg 1998; 124: 871–5.

e25. Bannermann E, Pendlebury J, Phillips F, et al.: A cross-sectional and longitudinal study of health-related quality of life after percutaneous gastrostomy. Eur J Gastroenterol Hepatol 2000; 12: 1101–9.

e26. Senft M, Fietkau R, Iro H, et al.: The influence of supportive nutritional therapy via percutaneous endoscopically guided gastrostomy on the quality of life of cancer patients. Supp Care Cancer 1993; 1: 272–5.

e27. Aschl G, Kirchgatterer A, Allinger S, et al.: Indikationen und Komplikationen der perkutanen endoskopischen Gastrostomie. Wien Klin Wochenschr 2003; 115: 115–20.

e28. Löser Chr, Müller MW: Ethical guidelines – percutaneous endoscopic gastrostomy (PEG tubes). Z Gastroenterol 1998; 36: 475–8.

e29. McCann RM, Hall WJ, Groth-Juncker A: Comfort care for terminally ill patients: the appropriate use of nutrition and hydration. JAMA 1994; 272: 1263–6.

e30. Gillick MR: Rethinking the role of tube feeding in patients with advanced dementia. N Engl J Med 2000; 342: 206–10.

e31. Finucane TE, Christmas C, Travis K: Tube feeding in patients with advanced dementia. JAMA 1999; 282: 1365–70.

e32. Cervo FA, Bryan L, Farber S: To PEG or not to PEG – A review of evidence for placing feeding tubes in advanced dementia and the decision-making process. Geriatrics 2006; 61: 30–5.

e33. Casarett D, Kapo J, Caplan A: Appropriate use of artifical nutrition and hydration – fundamental principles and recommendations. N Engl J Med 2005; 353: 2607–12.

e34. Chima CS, Barco K, Dewitt M, et al.: Relationship of nutritional status to length of stay, hospital costs and discharge status of patients hospitalized in the medicine service. J Am Diet Assoc 1997; 97: 975–8.

e35. Bernstein LH, Shaw-Stiffel TA, Schorow M, et al.: Financial implications of malnutrition. Clin Lab Med 1993; 13: 491–507.

e36. Elia M, Stratton R, Russell C, et al.: The cost of disease-related malnutrition in the UK and economic considerations for the use of oral nutritional supplements (ONS) in adults. Redditch: BAPEN 2005.

e37. Ockenga J, Freudenreich M, Zakonsky R, et al.: Nutritional assessment and management in hospitalised patients: implication for DRG-based reimbursement and health care quality. Clin Nutr 2005; 24: 913–9.

e38. EU-Declaration: Stop disease-related malnutrition and diseases due to malnutrition! 12. June 2009, Prague/Czech Republic. www.european-nutrition.org

e39. Detsky et al.: Subjektive Global Assesment. JPEN 1987; 11: 8–11.

e40. Kondrup et al.: Nutritional Risk Scores. Clin Nutr 2003; 22: 321–36.